

orbit. The greatest height of the body (at posterior third) of the type specimen (.447 m. long) is .013 m., and the height behind pectorals is .0055 m. The color is black.

| N. M. No.   | Station. | Latitude.      | Longitude.     | Fathoms. | Specimen. |
|-------------|----------|----------------|----------------|----------|-----------|
| 33369 ..... | 2076     | ° ' " 41 13 00 | ° ' " 65 33 30 | 906      | 1         |

*Labichthys elongatus.*

D. 316. A. 309 + *x*. (The anal is destroyed towards its end.) P. 19.

The ridges that bound the rostral groove are not confluent backwards in a cariniform extension, but end in a vertical from the orbit. The greatest height of the body (at posterior third) in the type specimen (.542 m. long) is .015 of a meter. The color is black.

| N. M. No.   | Station. | Latitude.      | Longitude.     | Fathoms. | Specimen. |
|-------------|----------|----------------|----------------|----------|-----------|
| 33577 ..... | 2100     | ° ' " 39 22 00 | ° ' " 68 34 30 | 1628     | 1         |

ON THE ANATOMY AND RELATIONS OF THE EURYPHARYNGIDÆ.

By THEODORE GILL and JOHN A. RYDER.

The remarkable fish called *Eurypharynx* was one of the fruits of the explorations of the French vessel *Travailleur* in 1882. A single specimen about a foot and a half long was obtained off the coast of Morocco at a depth of 2,300 meters (about 1,100 fathoms), and has been partially described by M. L. Vaillant under the name *Eurypharynx pelecanoiides*.

Three specimens of the same general type of fishes were found by the United States Fish Commission steamer *Albatross* in August and September, 1883, and might be considered to be generically and even specifically identical with *Eurypharynx pelecanoiides* were it not for several positive statements made by the describer of that species.

The problem of the relations of *Eurypharynx* to other fishes has been discussed by M. Vaillant with what appears to us to be negative results and one set of conclusions necessarily contravenes another. But it is only just to M. Vaillant to let the opinions as to the affinity of the fish enunciated by him be presented in his own language:

"We may say that the fish presents relations with the Anacanthini, with certain Physostomi, such as the Scopelidæ and Stomiidæ, and also with the Apodes. While it resembles these last in the want of ventral fins and the imperfection of the opercular apparatus, it differs from them too much in its well-developed and absolutely free intermaxillaries to allow it to be placed in the same group. As regards the Scopelidæ and Stomiidæ, all the known genera in those families have a very widely open branchial orifice: in the former the intermaxillary alone forms

the free border of the upper jaw; in the latter the maxillary forms part of it; and thus it would be the Scopelidæ that *Eurypharynx* would approach, especially as it does not present the hyoidean barbel which has hitherto been indicated as characteristic of the Stomiidæ.

“However, of all fishes it is to *Malacosteus niger*, Ayres, placed in the latter family by zoologists, that we are tempted to approximate the animal here under consideration; they alone present the simple arrangements of the suspensorium indicated above.

“But, finally, it is perhaps with the Anacanthini that its relations seem to be most real, whether we consider the form of the body, which greatly resembles that of *Macrurus*, or the absence of ventral fins, which is usual in certain animals of the group; thus several Ophididæ and all the Lycodidæ (the latter even having their branchial orifice reduced, although not to the degree that occurs in our animal) increase the probability attaching to this view. However, the characters of *Eurypharynx* are so strongly marked that in any case it is necessary to regard it as the type of a new family; and of this it would be the sole representative, unless subsequent investigations show that we must unite with it the genus *Malacosteus*.”—(Vaillant, *op. cit.*)

We are unable to appreciate any affinity of *Gastrostomus* to any Anacanthines, Physostomes, or typical Apods, nor does it seem to be at all related to *Malacosteus*, which has been universally considered to be a little modified Stomiid. Our own conclusions are expressed in the following arrangement.

The characters observed in the specimens collected by the Albatross may be segregated into several categories—(1) those disagreeing with structural characters exhibited by all normal Teleosts and which are paramount even to the characters usually considered to be of ordinal value; (2) those presumably common to the western and eastern Atlantic forms and which may be regarded as of family value; and (3) the characters alleged to be peculiar to *Eurypharynx* on one hand and on the other confirmed as to their discrepancey in the American form. In this order we here expose the cardinal characteristics of the Eurypharyngoid fishes in advance of a monograph in which we propose to describe and illustrate in detail their morphology, and discuss their relationship to other fishes, and especially to the Saccopharyngids and eel like types generally.

## ORDER LYOMERI.

Fishes with five branchial arches\* (none modified as branchiostegal or pharyngeal) far behind the skull; an imperfectly ossified cranium, articulating with the first vertebra by a basi-occipital condyle alone; only two cephalic arches, both freely movable, (1) an anterior denticerous one—the palatine, and (2) the suspensorial, consisting of the

\* “We find six pairs of interior branchial clefts, and consequently five branchiæ” in *Eurypharynx*.—VAILLANT.

hyomandibular and quadrate bones;\* without maxillary bones or distinct posterior bony elements to the mandible; with an imperfect scapular arch remote from the skull; and with separately ossified but imperfect vertebrae.†

#### FAMILY EURYPHARYNGIDÆ.

**Nouvelle famille** *Vaillant*, Comptes Rendus. Acad. Sc. Paris, t. —, p. 1226, Dec. 11, 1882 (not named).

**Eurypharyngidæ** *Gill*, Science, v. 1, p. 231, March 30, 1883.

Lymeres with the head flat above and with a transverse rostral margin, at the outer angles of which the eyes are exposed, with the jaws excessively elongated backwards and the upper parallel and closing against each other as far as the articulation of the two suspensorial bones, with minute teeth on both jaws, with a short abdomen and long attenuated tail, branchial apertures narrow and very far behind, dorsal and anal fins continued nearly to the end of the tail, and minute pectoral fins.

The mandibular rami are exceedingly narrow and slender, but the jaws are extremely expansible and the skin is correspondingly dilatible; consequently an enormous pouch may be developed. Inasmuch as the slenderness and fragility of the jaws and the absence of raptorial teeth (at least in *Gastrostomus*) preclude the idea of the species being true fish of prey, it is probable that they may derive their food from the water which is received into the pouch, by a process of selection of the small or minute organisms therein contained.

The peculiar closure of the anterior half of the upper jaws upon each other, and the co-ordinate joint between the hyomandibular and quadrate elements of the suspensorium are doubtless correlated with the mode of ingestion or selection of food. The skin constituting the pouch, it may be added, has a peculiar velvety appearance, and also reminds one of the patagium or wing membrane of a bat. But a more detailed summary of the salient characteristics of the type may be justly demanded at once.

#### OSTEOLOGY.

The skeleton is noteworthy for its simplicity or rather fewness of its parts, but the homologies of these parts are, for that very reason, not evident at first sight. We necessarily confine our attention to *Gastrostomus*, as the parts of *Eurypharynx* have not yet been described or figured.

The *cranium* above is really pentagonal, but apparently, in the main, transversely quadrate, expanding backwards around the foramen magnum (which is conspicuous from above) and forwards into the ethmoid expansion, which is separated from the main portion by a strangula-

\* "We find neither hyoidean apparatus nor opercular pieces."—VAILLANT.

† "It is important to indicate the complete absence of the swimming bladder."—VAILLANT.

tion; below it appears to have more of a pentagonal outline on account of the less irregularity of the surface near the contour.

The *notochord* is persistent in the skull for half the length of the basioccipital.

The *occipital condyle* is transverse and there are no lateral ones.

The *basioccipital* occupies nearly a third of the length of the base of the cranium.

There is a very small *supraoccipital* developed as a transverse bone above the foramen magnum and protruded forward as a triangular wedge between the parietals.

External to the exoccipital there is an *opisthotic* element, in front of which succeeds a discoidal element (which is probably the proötic) with which alone the hyomandibular articulates, not coming in contact with any other otic bones.

There are well-marked *exoccipitals* and *alisphenoids* which have more or less distinct sutural relations with adjoining bones, but their limits have not been clearly determined.

External to the parietals there is a *pteric* with lateral and ventral fossæ for the insertion of the strong muscles which move the jaws.

The *parasphenoid* is present and extends as a narrow splint from the hinder portion of the basioccipital to very near the end of the rostrum, where it widens and assumes a slightly spatulate form, resting free on the ethmoid expansion, there being no vomer developed.

The *presphenoid* has not been worked as to its limits anteriorly, but the fifth nerve passes out of the skull behind the alisphenoid in its usual relative position to other parts and immediately within and in front of the discoidal element lodged in a fossa behind the alisphenoid and below the pterotic, and with which the styliiform hyomandibular has an articulation admitting of a swinging movement, inasmuch as the pterotic itself is slightly mobile in relation to the adjacent bones.

The *parietals* are the best developed bones, and cover most of the hinder half of the cranium, those of the two sides being in contact from near the foramen to near the center of the roof.

In front of the parietals there are *postfrontals* which form laterally the posterior border of the orbit.

The *ethmoid* or rostral part of the cranium is cartilaginous or like the chondrocranium of the typical teleost in its histological characters.

The *orbital fossæ* open obliquely forwards and directly downwards, and there are no infraorbital bones.

The *nasal fossæ* are depressed excavations in the lateral region of the cranial rostrum, partly roofed over above and from behind by horizontally projecting cartilaginous ridges; they open obliquely forwards and outwards within a very short distance of the upper side of the end of the snout.

The foramen for the passage of the *ninth and tenth nerves* opens alongside the basioccipital and perforates the exoccipital.

There is *no vomer* developed, but a triangular cartilaginous element pendent from the cranial rostrum affords attachment for the palatine element anteriorly; this element is inclined obliquely downwards and backwards and is joined to the rostrum by its anterior border.

The *articular condyle* for the suspensorium, as already indicated, is a discoidal cartilaginous element (resting in a fossa under the lateral expansion of the cranium); it has a papilliform eminence in the center, which fits into a conical depression in the head of the slender hyomandibular bone; the hyomandibular, and especially the quadrate, are excessively elongated and articulate by an intermediary cylindrical cartilaginous bond, which reminds one of the intervertebral disks seen in the spinal column of mammals; this cartilage is ensheathed behind by a splint-like prolongation of the quadrate, which is prolonged and attenuated on the surface of the hyomandibular; the distal end of the quadrate is grooved longitudinally, forming, with the articular end of the mandible, a complete ginglymus joint.

The *vertebræ* are very numerous, and at the same time very simple and little differentiated from each other.

The vertebral *centra* are annular, and constricted in the middle like a dice-box, and the cavity of each vertebra is filled with vacuolated tissue, the remains of the chorda; the centra are connected together by cartilaginous annular ligaments.

The *neurapophyses* are slender, diverging (instead of convergent), cartilaginous distally, and embracing the neural sheaths on the sides, while by the neurapophyses is supported a membranous sheath which roofs over the nervous chord, and around which there is a wide serous space which extends into the cranium, expanding so that the serous space around the brain is as capacious relatively as, or more so than, in Elasmobranchs.

*Hamapophyses* are represented by parallel plates on the ventral face of the centra, and these plates are broadest at the ends of the vertebrae.

The first vertebra is shorter than those which follow, and the caudal vertebrae are simpler than those of the body and prebranchial region; at the extreme tip of the tail there are possibly no vertebrae differentiated, the skeletal axis of the body being represented by the notochord and its sheath.

The interspinous basalia of the median fin rays are composed of two pieces, one proximal, the other distal, with the articular extremities represented by cartilage.

The median fin rays at their base have cartilaginous articular portions mesially divided, the halves continued distally into the lateral halves of the unsegmented rays. The medulla or axial portion of the rays is not cartilaginous.

There is an eradiate ventral fold of ectoblast, as in embryo fishes. No dorsal or anal rays exist for some distance from the end of the tail. (These last are features which would indicate a defective development of the extreme caudal end of the bony skeletal axis of the body.)

## BRANCHIAL SYSTEM.

The branchial apparatus has five very short arches and six clefts, the arches being fringed with a double row of lamellæ, with cartilaginous axial supporting filaments. The very short branchial arches seem to have been backwardly displaced, and the clefts open downward instead of laterally. The clefts lie in a pair of anteriorly divergent furrows in the floor of the pharynx. The skeletal elements of the branchial apparatus are probably in large part cartilaginous and imperfectly developed. The branchiæ are covered by a soft integumentary fold, in which there are no apparent traces of branchiosteges.

## MYOLOGY.

The muscular apparatus which actuates the jaws and hyomandibular suspensor in *Gastrostomus* presents one very remarkable feature in that its cross-section apparently exceeds that of the dorso-ventral lateral muscular masses of the nape. These muscles operate (1) the mandible and (2) the hyomandibular and quadrate.

The mandible is extended by a powerful extensor muscle, lying behind and external to the hyomandibular. (Its belly, in our largest specimen, is about as long as that of the hyomandibular—about .035<sup>m</sup>, and its filiform tendon is partially ossified, and measures .065<sup>m</sup> in length, thus together constituting a total length of .10<sup>m</sup>.) Its origin is in the lateral cranial fossæ in the pterotic, and its insertion into the angular portion of the mandible, which is turned upward and backward over the distal end of the quadrate, like the olecranon of man. This muscle may be called the extensor of the mandible, and is practically placed posteriorly to the suspensor.

The other principal muscle originates anteriorly, externally and internally to the articulation of the mandibular suspensor, which depends obliquely backwards from the skull, and its belly is about .05<sup>m</sup> long and eight times the bulk of the mandibular extensor. Part of it passes down between the palatine and the suspensor internally, and its internal belly is prominent within the mouth, while its external belly is strongly marked from without, behind and below the eyes, immediately behind which its anterior origin from the skull begins. The dentigerous palatine is really anterior to it, but closely apposed, while a furrow in the posterior side of its belly receives the upper half of the suspensorium. Its origin largely covers the postorbital portion of the ventral face of the cranium nearly as far back as the basisphenoid and from the external ventral margin of the skull behind the eye to near the middle line. Its insertion seems to be partly into the angular portion of the mandible in front of its articulation with the quadrate and partly into the quadrate itself. Its function is to close the mandible and to divaricate and approximate the greatly elongated suspensor, which itself has a cartilaginous joint near its upper third, and enjoys a special mobility in virtue of its peculiar articulation with the cranium.

## SPLANCHNOLOGY.

The viscera are arranged in the abdominal cavity in a somewhat peculiar manner in that the black pigmented layer of the mouth and throat is continued back over a blind, saecular prolongation of the walls of the pharynx and œsophagus, the latter being so greatly widened as to scarcely be evident, except as defined by its relative position with respect to the branchiæ. This peculiar arrangement has given an unexpected significance to the generic name which we have proposed. While there is no very evident œsophageal constriction, both it and the pharyngeal part of the alimentary tract are very short, owing to the great reduction of the branchial apparatus.

The thin membranous parietes of the mouth and throat are thrown into numerous longitudinal, approximated, parallel folds, in harmony with the fact that the throat and mouth are very distensible. This wrinkling of the parietes of the pharyngeal region is apparent above the gills, which evidently open internally in the ventral part of the pharynx.

A darkly pigmented cæcal prolongation of the throat begins just above and behind the gills, and is lined with a thick deeply plicated secretory epithelium, the whole sack extending as far back as the first half of the body cavity; at the anterior lateral portion of this pigmented sack the widest, thick-walled part of the intestine arises on the right side and extends backward under the dark-walled cæcal pouch along the middle line between the thick and symmetrically disposed liver, which lies against either side of both the dark pouch and the first portion of the intestine, and extends for about half the length of the abdominal cavity. Behind the liver the intestine becomes suddenly narrower, and has two flexures, but is not very sharply bent upon itself.

The pigmented cæcal part of the alimentary tract seems to be the stomach, from which it is probable that the food is passed after partial digestion to the thick-walled anterior portion of the intestine proper, lying just below it and opening into it at its anterior part.

The mode in which the food is collected is probably as suggested before, namely, by filling the mouth with water containing small organisms which are retained and left in the pharynx above the gills as the water is strained through the latter. The wrinkles in the oral and pharyngeal integument would indicate that the latter probably contains scattered muscular fibers and is itself contractile.

The abdominal cavity is separated from the cardiac by a septum, in front of which there is a well-developed heart of the usual type with an atrial sinus, ventricle, and bulbus aortæ. The heart lies in a very thick-walled pericardial sac.

No air-bladder or rudiment of such a structure has been discovered in our specimens.

The renal organs lie in the hinder part of the abdominal cavity, ex-

tending for half its length as a thick agglomerated mass of nephric tubules external to the peritoneum.

Behind the liver, in the female, the ovary is developed on either side of the mesentery for half the length of the body cavity. It is composed of series of free slightly plicated lobes which depend into the abdominal cavity on either side of the intestine. No peritoneal tunic embraces the ovarian organ, and there is no oviduct, the ova escaping from the body by way of a conspicuous pore immediately behind the vent.

The following facts in regard to the genesis of the ova have been made out: The ova probably drop from the naked ovigerous lamellæ, as they rupture their follicles, into the abdominal cavity. In our specimen the ova were found to be immature, but were probably within a couple of weeks of the mature state, judging from their large size (.0007 meter, in diameter), so that the animal probably spawns in the autumn. No very immature or very young ova were noticed in the ovarian stroma, which would indicate that the spawning season was near at hand. (The specimen was obtained September 3d.)

There is probably present in the eggs when they are full grown oil, which appears to be superficially embedded in the vitellus in the ovarian eggs which were examined. The proof that the ova studied by us were immature consists in the fact that there still seemed to be present a nuclear body in the center of the vitellus when the eggs were stained with safranin and the superfluous color abstracted with alcohol.

What now are the deductions to be derived as to the systematic relations of the Eurypharyngids? We cannot agree with M. Vaillant that they have any relations with the Anacanthini, with certain Physostomi, such as the Scopelidæ and Stomiatidæ, and also with the Apodes, nor that they are at all approximated to the genus *Malacosteus*. On the contrary, in our opinion, there are few fishes more removed from them than the Anacanthines, and the Scopelids and Stomiatids (including *Malacosteus*) are also extremely divergent. It is true that the latter exhibit an analogous extension of the oral fissure, but the little value of that character is evident from the gradation of the wide-mouthed forms of their series into those having normally cleft ones. Furthermore, the extension of the peristomal elements has been attained by entirely different methods in the two types. In the Scopelids and Stomiatids, the upper jaw is constituted by the hypertrophied intermaxillaries or supramaxillaries, and the palatines are conversely reduced, while in the Eurypharyngids the upper arcade of the mouth is constituted solely by the liberated and excessively elongated palatine bones, and the maxillaries are entirely wanting.

It is then with the true Apodal fishes that the Eurypharyngids may be most aptly compared. In that series we find a gradation from those forms exhibiting nearly the typical Teleostean type of structure to those in which the palatine bones alone form the superior arch of the mouth



and other elements are atrophied or entirely absent. The Murænid<sup>\*</sup> are those forms exhibiting the greatest degree of degradation of the cephalic arches. But it is by no means certain yet that the Eurypharyngids are derived from the same primitive stock as the Murænidæ. On the contrary, the evidence thus far furnished by our anatomical investigations lead us to believe that they are the offshoots of a primitive phylum cognate with the specialized Apodes, but far back in the phyletic history of those diversiform (or rather diversistructural) fishes. The common characters are rather the results of teleological modification resulting from analogous conditions, or rather conditions entailing analogous structures, than of common origin. For the present, therefore, we propose to isolate the Eurypharyngids as the representatives of a distinct order and to place that order next to the Apodes. As an ordinal name we propose *Lyomeri*, † by which we intend to point at the loose connection of the palatine and suspensorial elements and the isolation of the branchial and scapular arches from the cranium.

Whether any of the other known types of fishes belong to this order is very doubtful, and, in fact, we have sufficient data respecting them to be tolerably certain that none do, unless it may be the *Saccopharynx flagellum*. *Saccopharynx* is a very peculiar type, the representative of quite an isolated family, but its structure is almost unknown. The last systematic writer who has referred to its characters (Dr. Günther) has described the genus as consisting of "deep-sea congers, with the muscular system very feebly developed, with the bones very thin, soft, and wanting in organic matter; head and gape enormous"; "maxillary and mandibular bones very thin, slender, arched, armed with one or two series of long, slender, widely set teeth, their points being directed inwards," &c.‡ Dr. Günther's "maxillary" bones are doubtless palatines, and his description is very deficient in precision, but supplemented as it is by the descriptions of Mitchill and Harwood, it is evident that the genus *Saccopharynx*, or family Saccopharyngidæ, is quite remote from the Eurypharyngidæ. More than this can only be surmised at most till its structural characteristics are determined.

The question must hereafter arise whether the fishes examined by M. Vaillant and ourselves are the same or really distinct generic types. Little value is to be attached to the relative extension (within the limits observed) of the jaws, but the proportions of the cranium (if confirmed) would indicate that the two forms exhibit marked differences, and our respect for the eminent French naturalist will not permit us to

\* We understand by the term "Murænidæ" the natural family represented by *Muræna* and closely related genera only, and not the heterogeneous medley called the "family Murænidæ" by Dr. Günther. See Cope's memoir in Trans. Am. Phil. Soc., v. 14, p. 456; Gill's "Arrangement of the families of Fishes," p. 20, and Jordan & Gilbert's "Synopsis of the Fishes of North America," p. 355.

† *Λυοῦς*, loose, and *μερὸς*, part or segment.

‡ Günther (Albert C. L. G.): An Introduction to the Study of Fishes, 1880, p. 670.

assume error on his part in reference thereto, and, consequently, we propose (provisionally at least) to differentiate the two forms as follows:

## EURYPHARYNX.

*Eurypharynx* Vaillant. Comptes Rendus Acad. Sc. Paris, t. —, p. 1232, Dec. 11, 1882 (tr. Ann. & Mag. Nat. Hist. (5), v. 11, p. 67).

Eurypharyngids with the cranium prolonged backwards, the dentigerous bones little more than three times as long as the cranium;\* "faint dentary granulations" on both jaws, and at the extremity of the mandible "two hooked teeth";† and the tail terminating in a point.

## EURYPHARYNX PELECANOIDES.

*Eurypharynx pelecanoides* Vaillant.

## GASTROSTOMUS.

*Gastrostomus* Gill & Ryder.

Eurypharyngids with the cranium abbreviated and little or no longer than broad, the dentigerous bones almost seven times as long as the cranium; minute acute conic teeth depressed inwards in a very narrow band on the jaws (no enlarged teeth at the extremity of the mandible), and the tail with an eradiate membrane under its terminal portion.

## GASTROSTOMUS BAIRDII.

*Gastrostomus bairdii* Gill & Ryder.

The cranium forms about one-thirtieth or less of the extreme length, and is as broad as long; the jaws are excessively elongated, being nearly (in large) or more (in young) than seven times longer than the cranium; there are about 160 rays in the dorsal fin and about 107 in the anal; the pectorals are very small, being only about as long as the diameter of the eye, and little more than twice as long as wide at the base, and have about nine simple rays. The rays of the unpaired fins are quite flexible in the small individuals, but quite rigid and more perfectly ossified in the larger; they become obsolete toward the end of the tail. The rays, which are rigid and well ossified anteriorly, become shorter,

\* "This animal, about 0.47 metre long and 0.02 metre high at the most elevated part, is of an intense deep black color. The body, the form of which is masked in front by the abnormal mouth, which will be mentioned further on, resembles that of *Macrurus*; it becomes regularly attenuated from about the anterior fourth, the point at which the external branchial orifice is seen, and terminates in a point at the caudal extremity; the anus is situated at the junction of the anterior third with the posterior two-thirds of the body.

† "What gives this fish a very peculiar physiognomy is the arrangement of the jaws and the structure of the mouth, which are even an exaggeration of what Mr. Ayres has described in *Malacosteus niger*. Although the head is short, scarcely 0.03 metre, the jaws and the suspensorium are excessively elongated; the latter did not measure less than 0.095 metre; and from this it results that the articular angle is carried very far back, to a distance from the end of the muzzle equal to about three and a half times the length of the cephalic portion."

† "On both jaws one can feel faint dentary granulations; at the extremity of the mandible there are two hooked teeth 0.002 metre long."

very slender, and flexible—in fact almost as limp as threads near the end of the tail. The vertebral bodies become longer and more attenuated toward the end of the tail.

|  | Metre. |
|--|--------|
| Extreme length .....                     | .47    |
| Body:                                    |        |
| Height at branchial region .....         | .035   |
| Height at anus .....                     | .025   |
| Height at commencement of anal fin ..... | .02    |
| Length of abdominal cavity .....         | .05    |
| Cranium:                                 |        |
| Length .....                             | .015   |
| Width .....                              | .015   |
| Interorbital area .....                  | .011   |
| Orbit, diameter .....                    | .003   |
| Jaw:                                     |        |
| Upper, length .....                      | .103   |
| Lower, length .....                      | .103   |
| Suspensorium, length .....               | .102   |
| Branchial aperture:                      |        |
| From snout .....                         | .11    |
| From dorsal .....                        | .028   |
| Interbranchial isthmus, width .....      | .0035  |
| Dorsal:                                  |        |
| From snout .....                         | .07    |
| Longest ray .....                        | .0075  |
| Anal:                                    |        |
| From snout .....                         | .175   |
| Longest ray .....                        | .015   |
| Pectoral:                                |        |
| Distance from branchial aperture .....   | .002   |
| Distance from anus .....                 | .04    |
| Distance from snout .....                | .115   |
| Length .....                             | .0035  |
| Width (at base) .....                    | .0015  |

The vertebrae of *Gastrostomus Bairdii*, as observed in the mutilated medium-sized specimen, are as follows:

|   |    |
|---|----|
| Total number? .....   | 97 |
| (The last two or three caudal are not distinguishable by dissection.) |    |
| Number intervening between cranium and branchiæ .....                 | 16 |
| Number between branchiæ and vent .....                                | 6  |
| Number in tail .....  | 75 |
| Vertebral formula (approximately) 22 + 75 .....                       | 97 |

The three specimens of this species secured were found at different times and in quite different depths of water, as will be seen from the following exhibit:

| N. M. Nos.  | Station. | Latitude. | Longitude. | Fathoms. |
|-------------|----------|-----------|------------|----------|
|             |          | ° ' "     | ° ' "      |          |
| 33204 ..... | 2047     | 40 02 30  | 68 49 40   | 389      |
| 33295 ..... | 2043     | 39 49 00  | 68 28 30   | 1,467    |
| 33386 ..... | 2074     | 41 43 00  | 65 15 20   | 1,309    |

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The proportions of the three specimens of *Gastrostomus* essentially agree as to those points for which measurements have been given by M. Vaillant, and their ratios and the discrepancy therefrom of the type of *Eurypharynx* may be judged from the following table :

|                           | E.   | G. 1. | G. 2. | G. 3. |
|---------------------------|------|-------|-------|-------|
| Extreme length.....       | .47  | .47   | .235  | .149  |
| Cranium :                 |      |       |       |       |
| Length.....               | .03  | .015  | .0075 | .0045 |
| Width.....                |      | .015  | .0075 | .0045 |
| Suspensorium, length..... | .095 | .102  | .053  | .0335 |

There is no *à priori* improbability of the existence of two or even many generic modifications of the Lyomerous type, and differences like those represented by the preceding diagnoses are such as might naturally be expected.

**ORNITHOLOGICAL NOTES ON COLLECTIONS MADE IN JAPAN FROM JUNE TO DECEMBER, 1882.**

By **PIERRE LOUIS JOUY.**

INTRODUCTION.

Accompanied by Mr. A. J. M. Smith, I left Yokohama on the morning of the 23d of June, 1882, for an ornithological trip to Fuji-yama. This, the highest mountain in Japan, is a favorite breeding-ground for many species of birds, both migratory and resident; centrally situated and having an altitude of over 12,000 feet above the sea level, it affords every favorable condition of environment.

Traveling by the ordinary hand-carriage, or kuruma, we accomplished about 35 miles of our journey, which was as far as the condition of the roads would allow. We then walked on to Tonozawa, a small place where we had a bath heated by a natural spring, and also secured very good accommodations for the night.

From Tonozawa to Ashinoyu, by mountain paths, through several small villages, occupied the next day. Sulphur springs of varying temperature, from 85° Fah. to boiling point, abound in these hills, and are utilized largely for bathing purposes. The water is conducted by means of bamboo pipes to the houses and public bathing places, and in many of the towns hot and cold water flow side by side through the principal street.

Here, as in Switzerland, the people are mainly engaged in cabinet work, turning and carving; many grotesque objects are made out of the roots of trees. Although mills run by water-power abound, yet they